

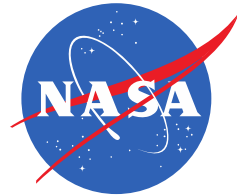
SysML 2.0 Interface Concepts

Modeling Core Team

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BAE SYSTEMS

Primary Goals for Interface Modeling

- The information captured in the model includes equivalent information that is generally contained in an interface specification document and interface design document (e.g. IRS, IDD, ICD, ...)
- The interface concepts are consistent with the behavior, structure, and other concepts of the language
- The concepts of interface specification and interface realization are distinct such that the model can clearly capture how interface specifications can be realized.
- Ensure a consistent approach to model a diverse range of interfaces (e.g. electrical, mechanical, software, user IF), and include the ability to model Modelica-like physical interface concepts and flow based concepts
- Ensure ability to support nested interfaces and reusable interfaces
- Ensure the ability to readily model different interface viewpoints that address a broad range of interface concerns

Context

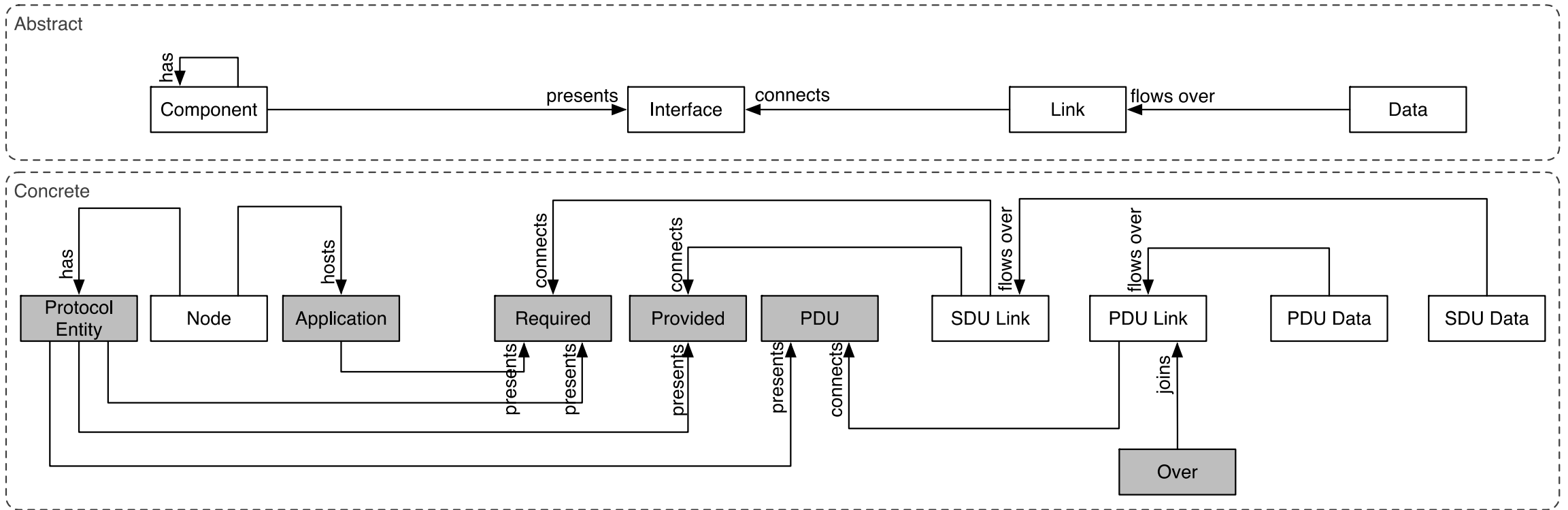
- Elaborate Interface Concept Model in context of Structure WG
- Incorporate concepts from prior interface modeling work
- From interface needs document there are three orthogonal dimensions
 - Interface Definition vs Interface Usage
 - Interface Specification vs Realization
 - Interface Layers (e.g. OSI protocol layers)
 - Levels of Abstraction (e.g. showing and hiding detail and intermediate systems)
- Will address first three.
- Assume that Levels of Abstraction is handled by Visualization and Model Construction groups.

Definition of Interface

- We take the definition of an interface to include:
 - The things on either end
 - The connection between them

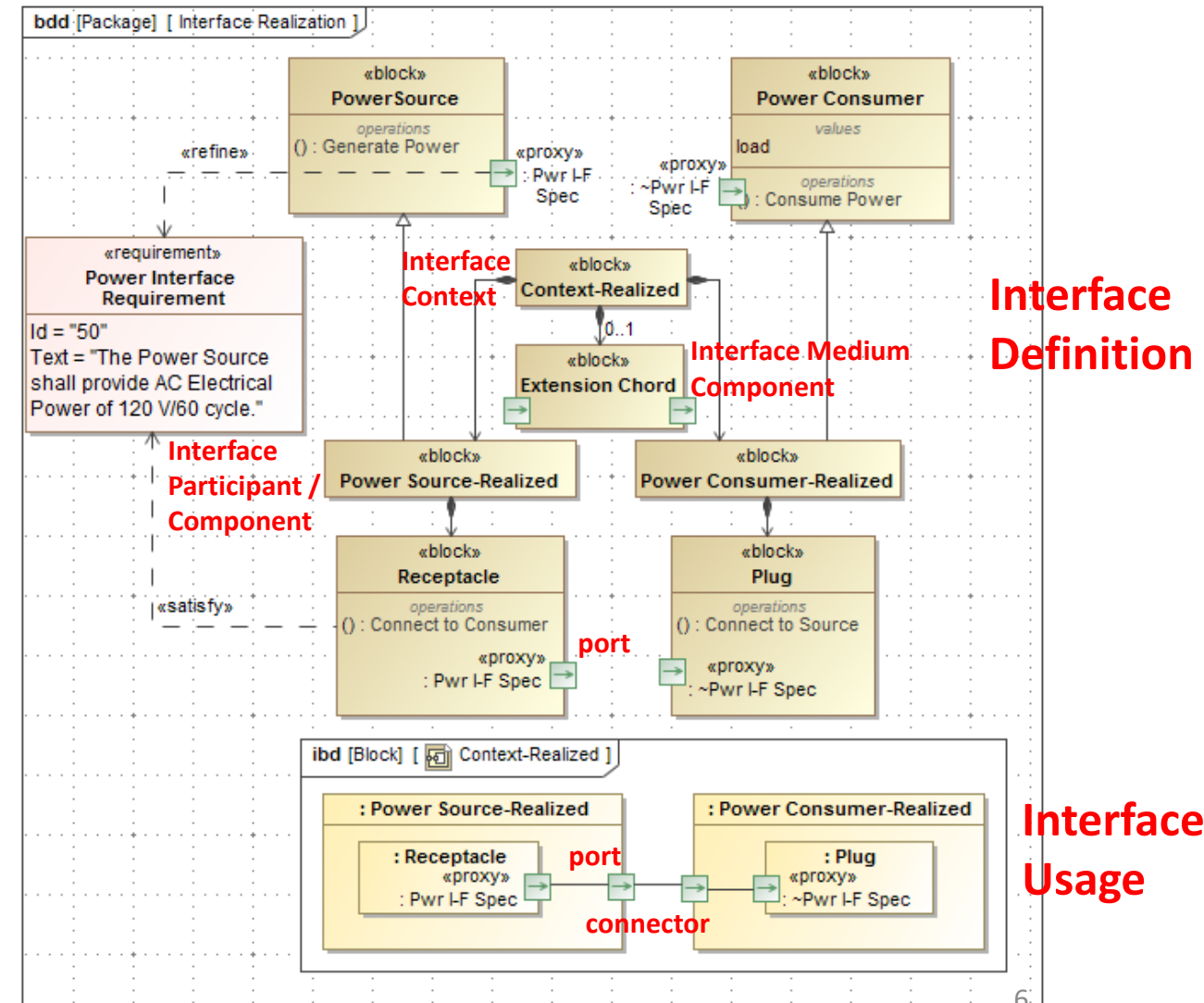
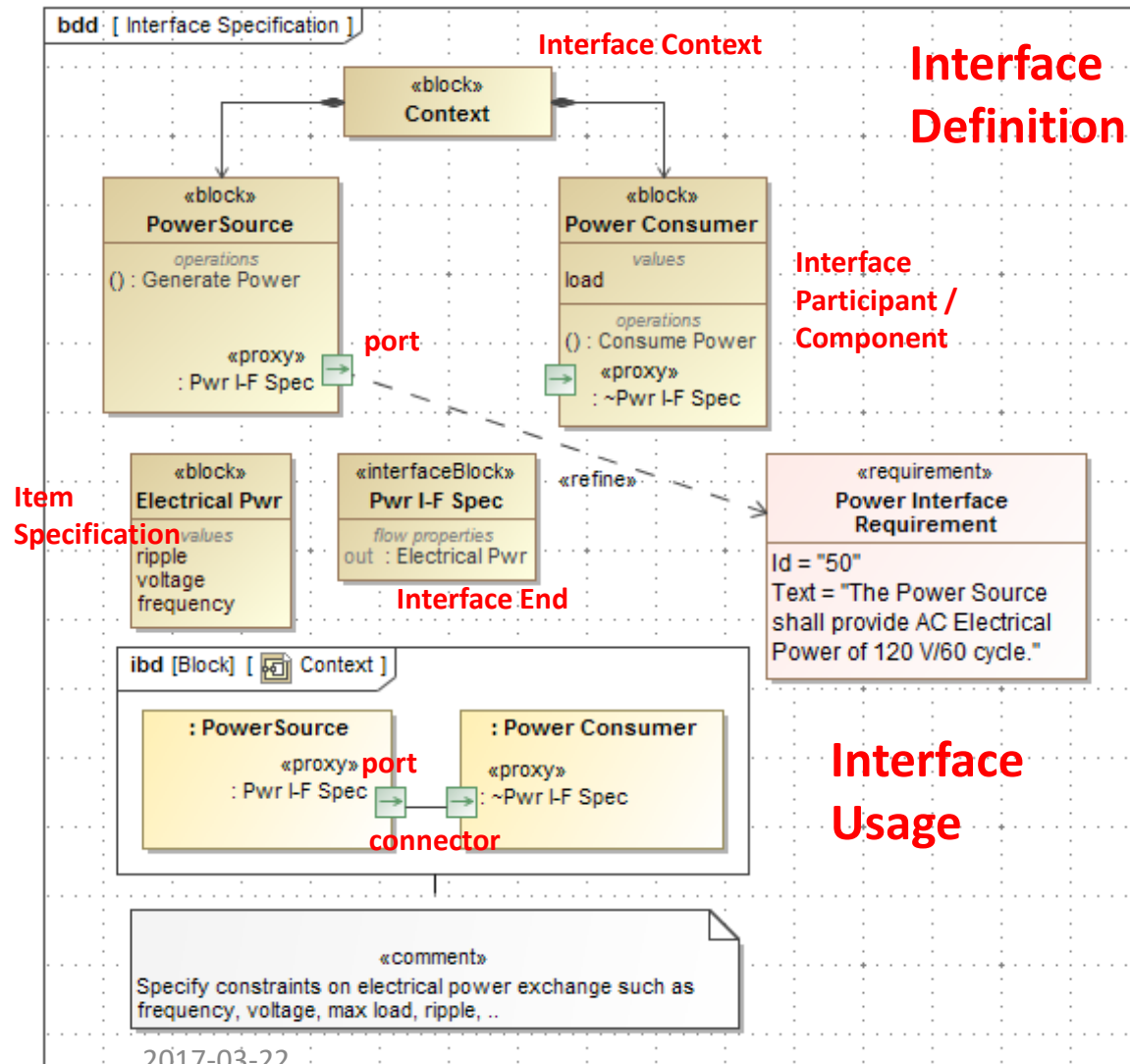


- This applies both for the Interface Definition and the Interface Usage

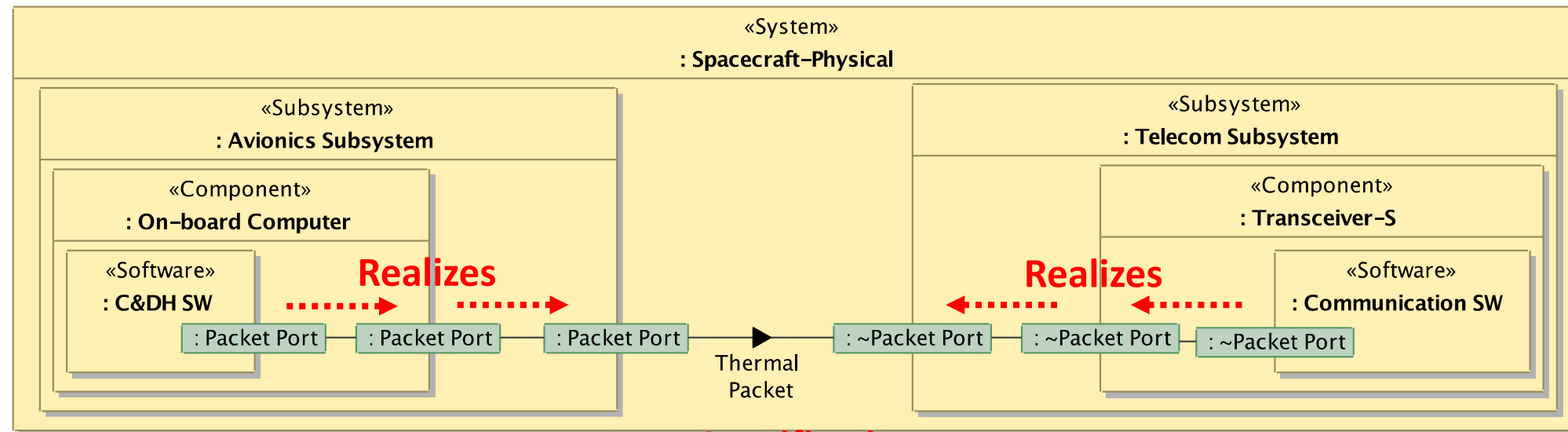


Specification vs Realization

Have changed concept model in this area. No longer have separate concepts for specification and realization.



[Black Box]



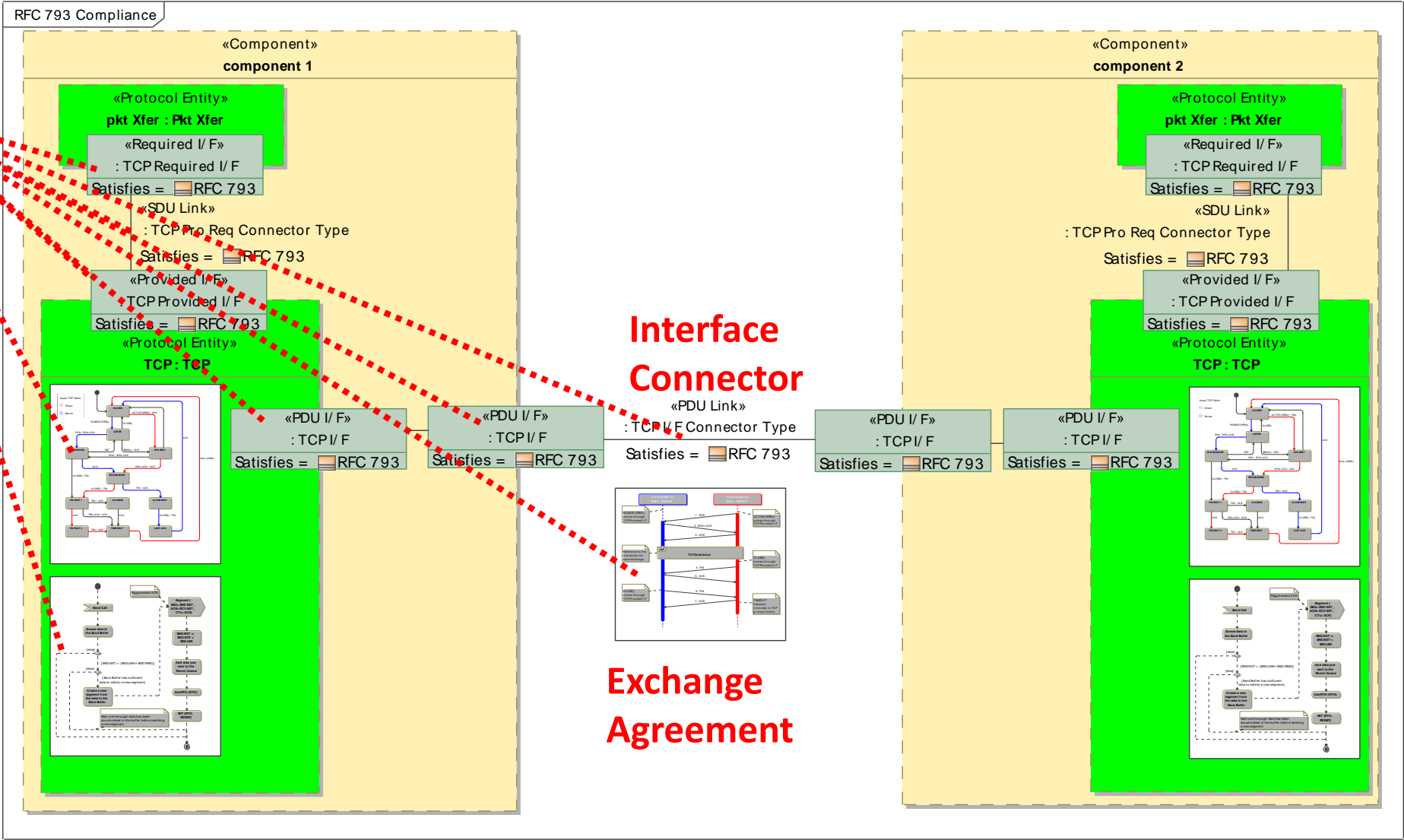
Item Specification

Component

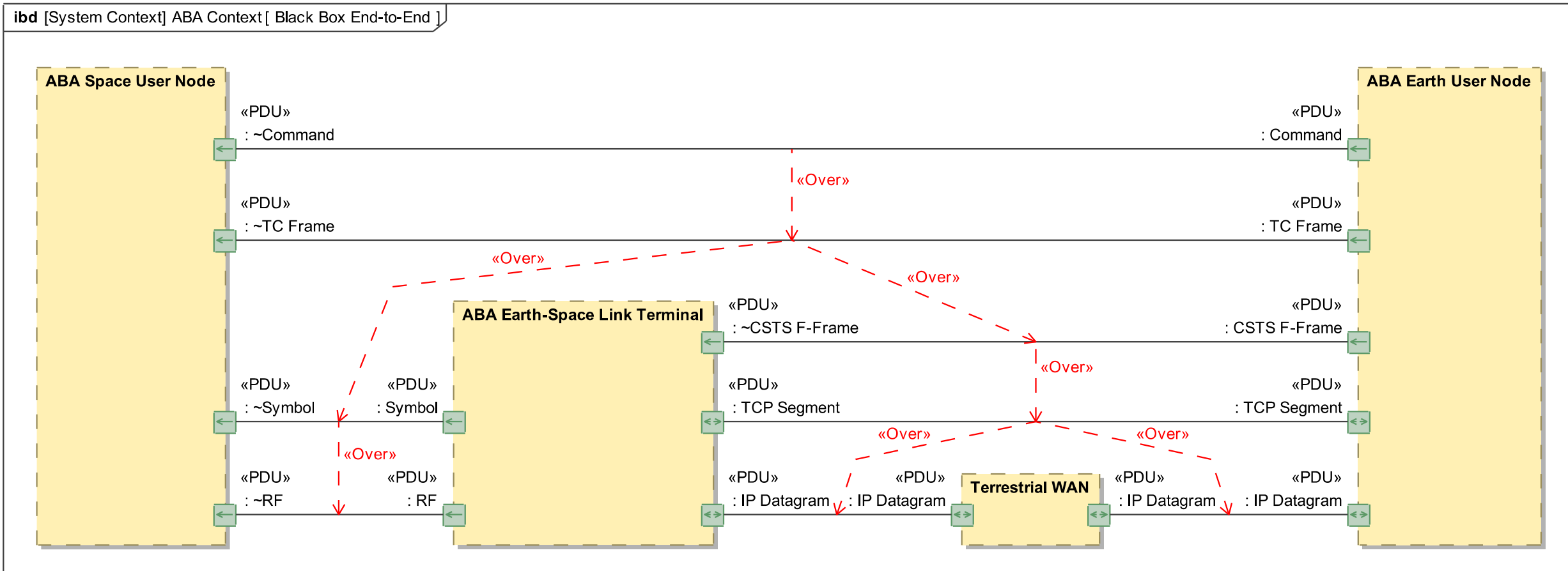
RFC 793

Realizes

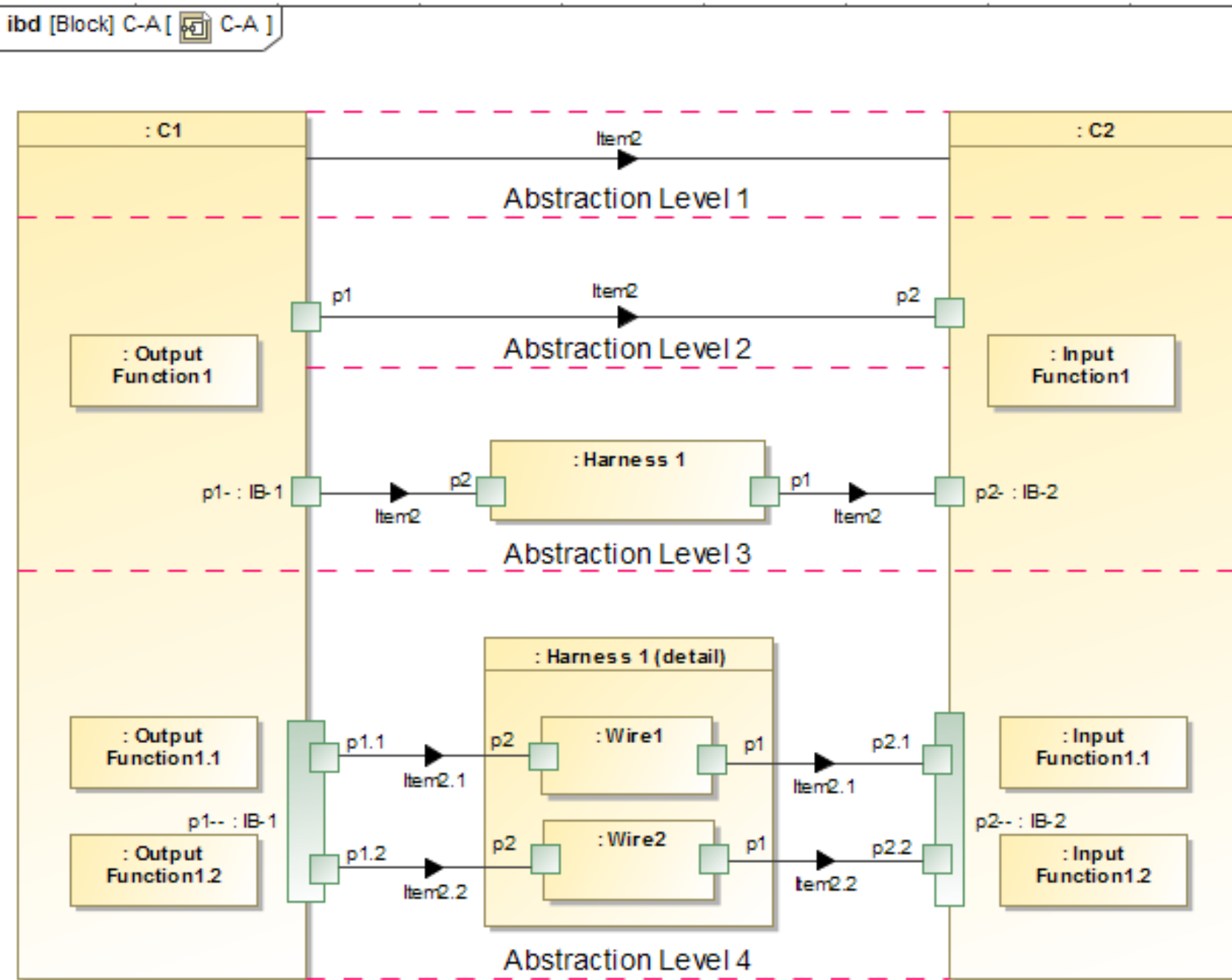
Component Behavior

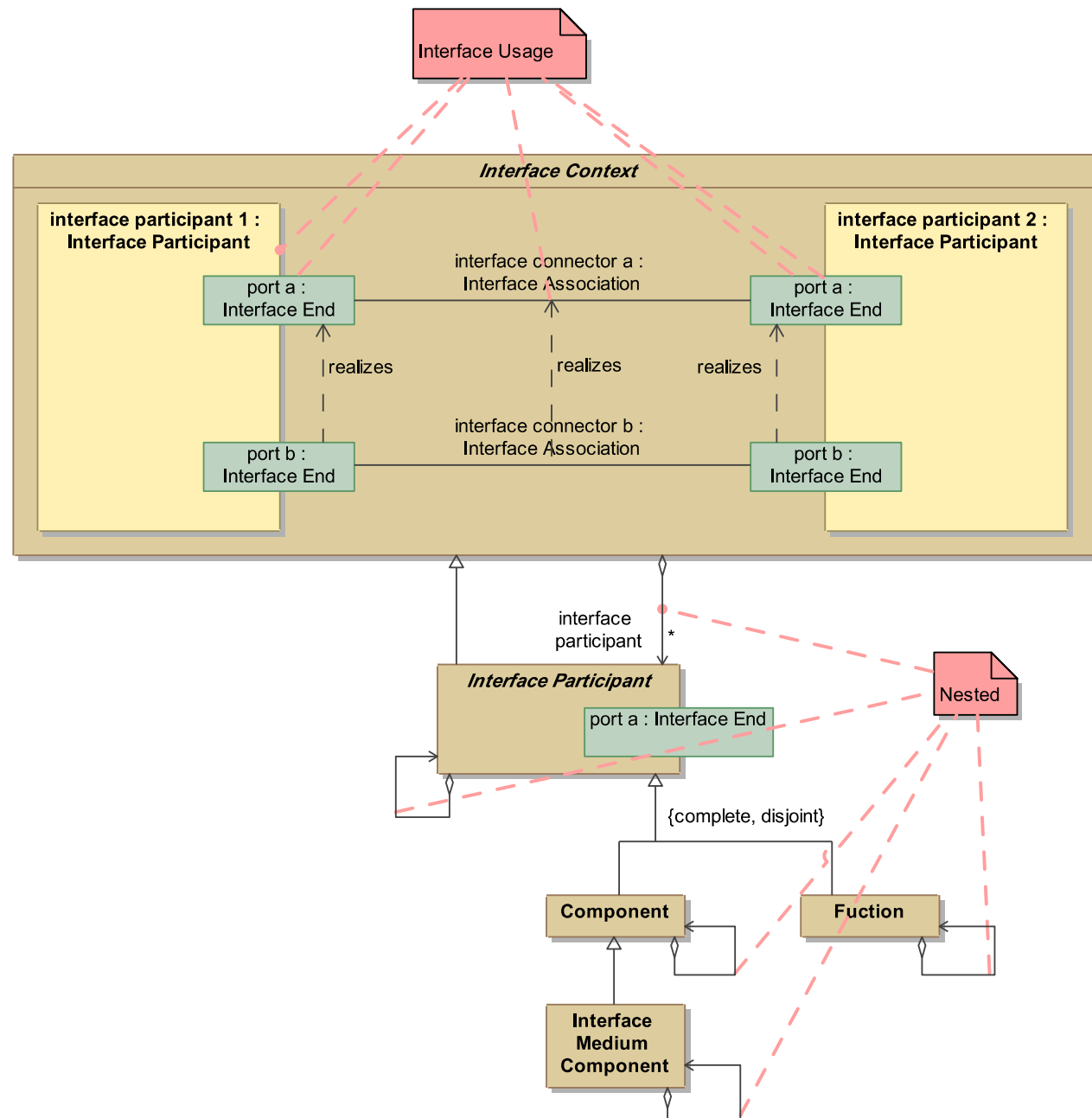


Interface Layers



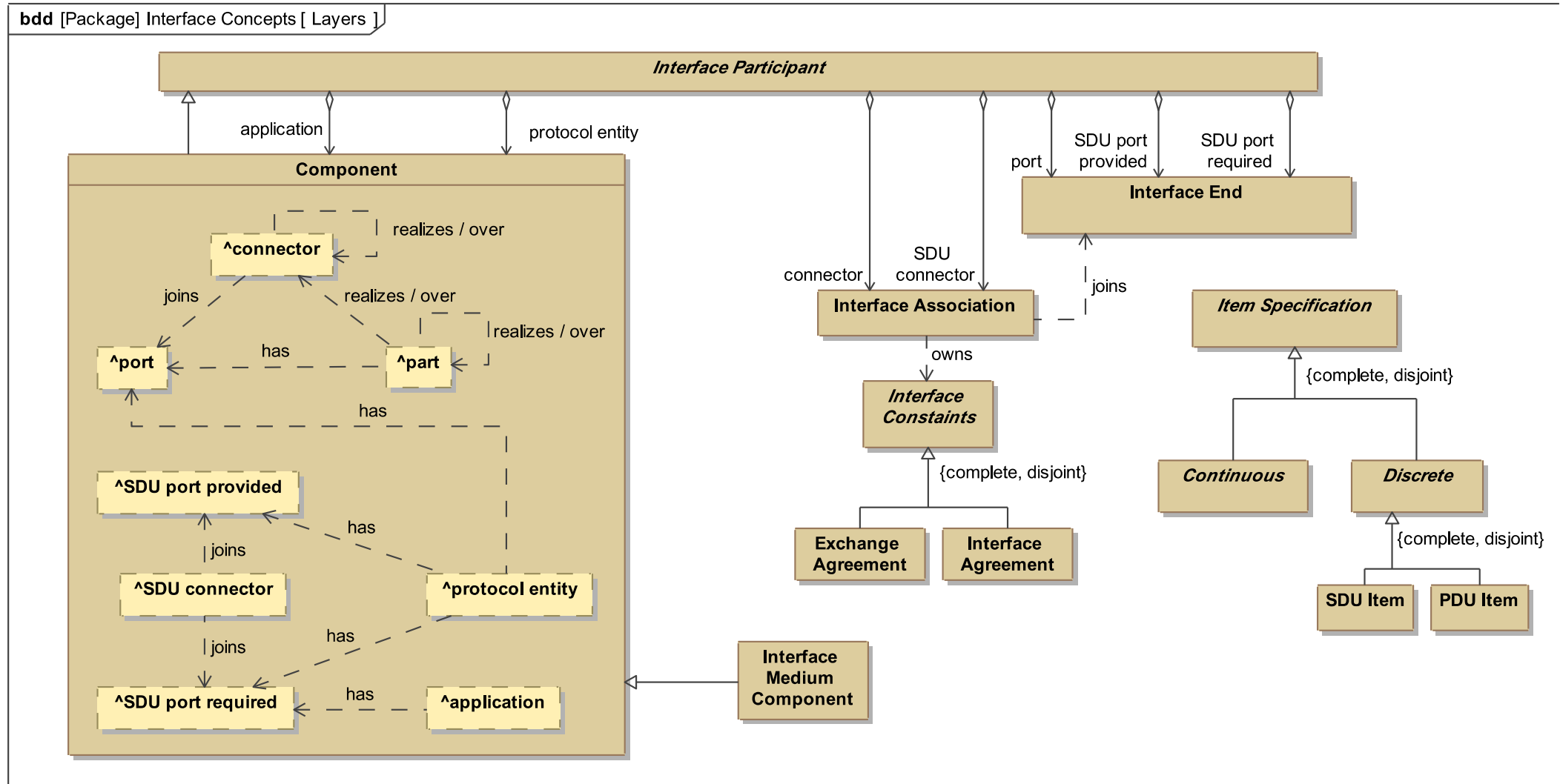
Levels of Abstraction





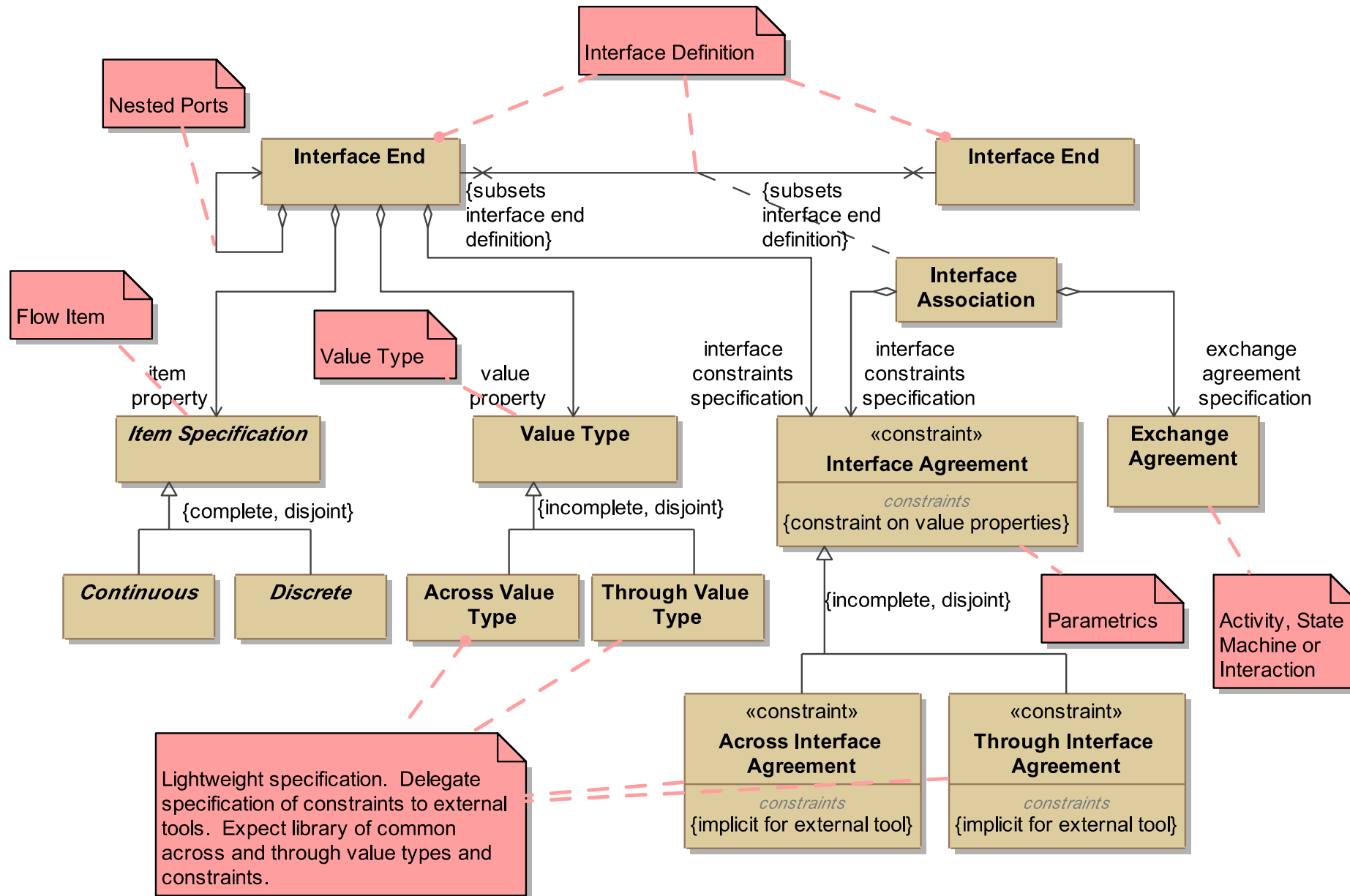
Interface Concept Model 1

Interface Concept Model 2



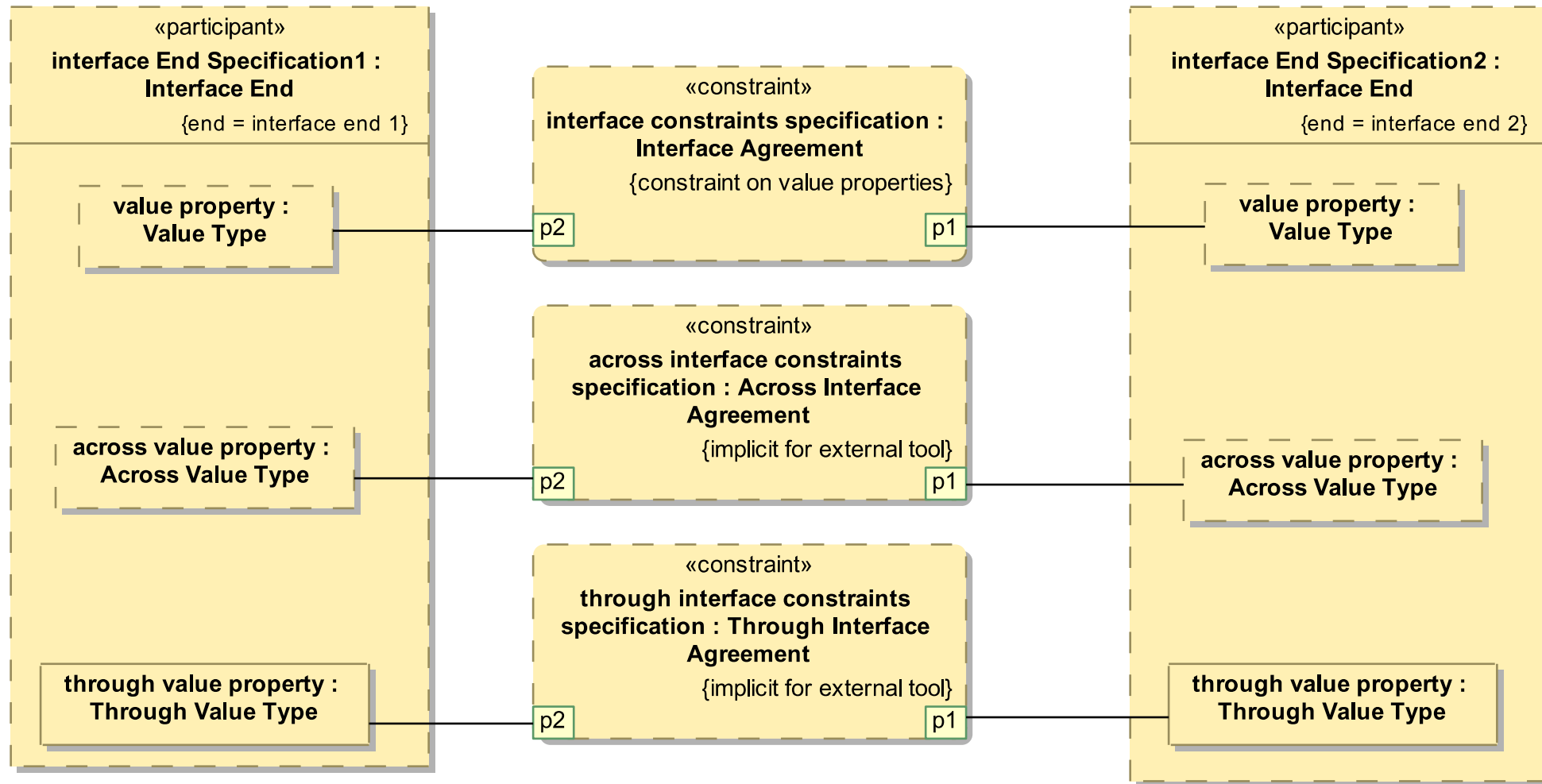
Interface Concept Model 3

bdd [Package] Interface Concepts [Association]

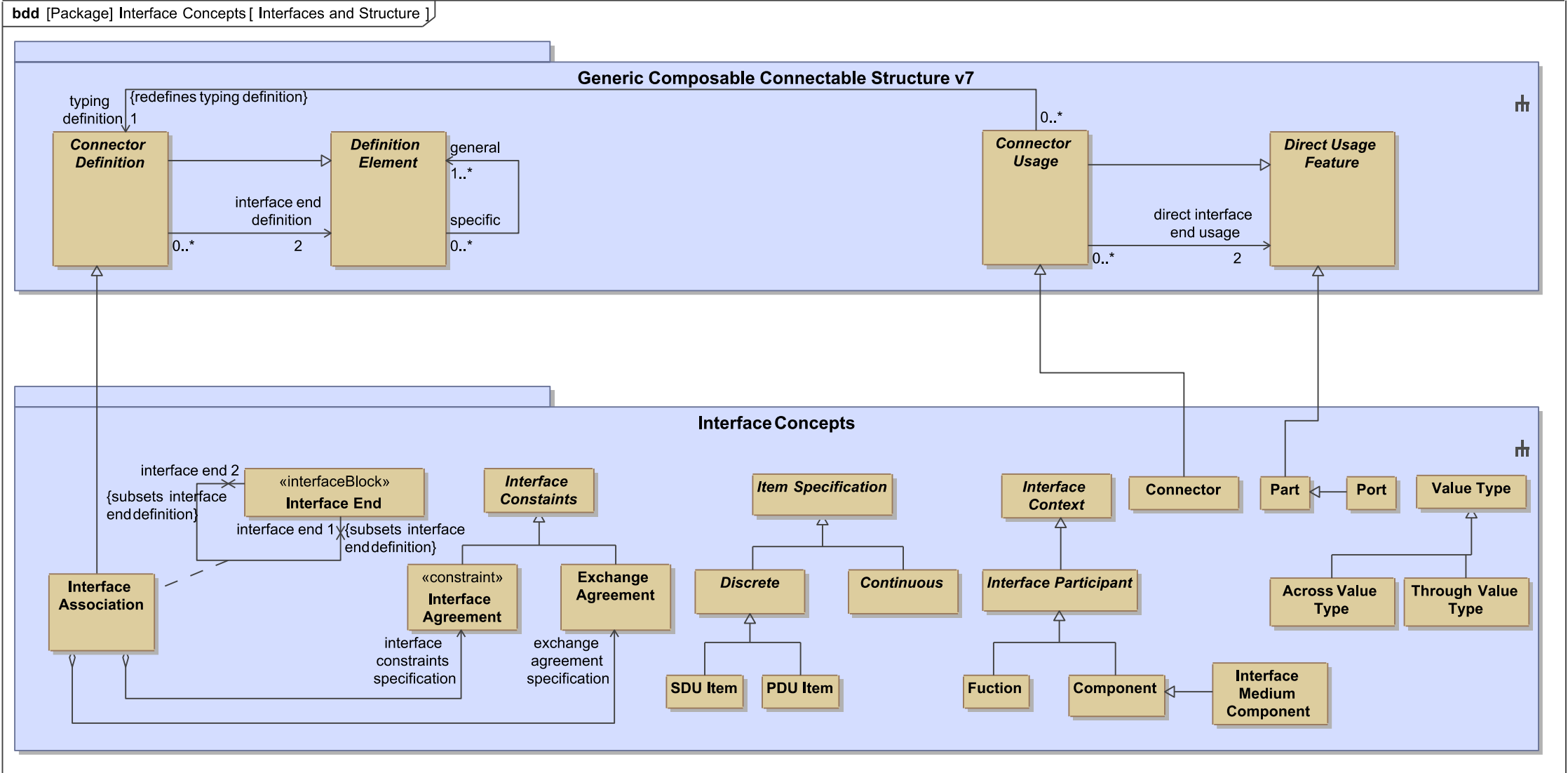


Interface Concept Model 4

par [Block] Interface Association [Physical Interaction]



Mapping to Structure Concepts



Id	Name	Text
ITF 1	Interface Requirements Group	<p>SysML v2 is intended to provide a robust capability to model interfaces that constrain the interaction between structural elements. An interface in SysML v2 includes two (2) interface ends, the connection between them, and any constraints on the exchange between the ends. An interface should support the following: a) different levels of abstraction from logical to physical interfaces, nested interfaces, and interface layers; b) diverse domains that include a combination of electrical, mechanical, software, and user interfaces; c) reuse of interfaces in different contexts ; d) generation of interface control documents and interface specifications</p> <p>Note: The ability to construct and visualize different views of interfaces including different abstraction levels are addressed by the visualization and construction services.</p>
ITF 1.1	Interface Usage	SysML v2 shall provide the capability to represent an interface that constrains the interaction between any two (2) structural elements.
ITF 1.2	Interface Definition and Reuse	<p>SysML v2 shall provide the capability to define an interface that can be used in different contexts that includes the definition of the interface ends, the interface connections, the items that are exchanged, and the interface constraints.</p> <p>Supporting Information: Note: Interfaces must conform to the structural concepts of definition and usage)</p>
ITF 1.3	Interface Decomposition	SysML v2 shall provide the capability to represent nested interfaces, such as when modeling two electrical connector with pin to pin connections. (Note: Interfaces must conform to the structural concepts of definition and usage)
ITF 1.4	Interface End Definitions	SysML v2 shall provide the capability to represent an Interface End whose features constrain the interaction that it can participate in, including items that can be exchanged and their direction, behavioral features that are provided or requested, and constraints on properties.
ITF 1.5	Item Definitions	<p>SysML v2 shall provide the capability to represent Item Specifications that define the kind of items that can be exchanged between Interface Ends.</p> <p>Supporting Information: Item Specification may be marked as continuous or discrete time.</p>

Id	Name	Text
ITF 1.6	Interface Agreement	
ITF 1.6.1	Item Exchange Constraints	SysML v2 shall provide the capability to constrain the interaction between the interface ends that includes constraints on the items to be exchanged, the allowable sequences and directions of those items, timing of the exchange and other characteristics. The items exchanged shall be consistent with the type and direction of the items specified in the connected Interface Ends.
ITF 1.6.2	Property Constraints	<p>SysML v2 shall provide the capability to constrain the interaction between the interface ends that include mathematical constraints on the properties exposed by the Interface Ends.</p> <p>Supporting Information: The properties may further be marked as Across or Through variables consistent with standard usage of the terms, e.g. across and through variables, for specifying properties that are constrained by conservation laws).</p>
ITF 1.6.3	Geometric Constraints	SysML v2 shall provide the capability to constrain the interaction between the interface ends that include geometrical constraints on either Interface End (e.g., plug and socket).
ITF 1.7	Interface Medium	<p>SysML v2 shall include a capability to represent an Interface Medium that describes the communications channel between Interface Participants.</p> <p>Supporting Information: The Interface Medium may represent either an abstract or physical channel, and may connect one to many participants to support peer-to-peer, multi-cast and broadcast communications.</p>
ITF 1.8	Interface Layers	<p>SysML v2 shall provide the capability to represent interfaces between structural elements that represent a specified layer of an interface stack, and connections between structural elements in adjacent layers of an interface stack.</p> <p>Supporting Information: An exchange at an upper layer in a stack may be realized by transforming the data to match the next lower layer, performing the exchange at that lower layer, and then performing the inverse of the data transformation. In order for the layered interface as a whole to work together, each layer must meet its requirements separate.</p>
ITF 1.9	Allocating Functional Exchange to Interfaces	SysML v2 shall provide the capability to allocate functional exchanges to interfaces including the interface ends, item exchanges, and/or interface connections, and validate the consistency between the functional exchange and the interface.